

begins to decrease, as well as the observed upper limit on the sea surface temperature, are relevant to several aspects of paleoclimatology and astrobiology. We will use our model to predict the upper limit of sea surface temperatures for different levels of atmospheric carbon dioxide, an objective directly relevant to understanding past and future climate states of the Earth. For example, did these same processes prevent the oceans from evaporating during past climate episodes of enhanced carbon dioxide? Evidence suggests SST never exceeded 303K.

Detecting and Identifying Organic Molecules in Space - The AstroBiology Explorer (ABE) MIDEX Mission Concept

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Infrared spectroscopy in the 2.5-16 μm (4000-625 cm^{-1}) range is a principle means by which organic compounds are detected and identified in space. Ground-based, airborne, and spaceborne IR spectral studies have already demonstrated that a significant fraction of the carbon in the interstellar medium (ISM) resides in the form of complex organic molecular species. Unfortunately, neither the distribution of these materials nor their genetic and evolutionary relationships with each other or their environments are well understood. The Astrobiology Explorer (ABE) is a MIDEX (Medium-class Explorer) mission concept currently under study at NASA's Ames Research Center in collaboration with Ball Aerospace and Technologies Corporation. ABE will conduct IR spectroscopic observations to address outstanding important problems in astrobiology, astrochemistry, and astrophysics. The core observational program would make fundamental scientific progress in understanding (1) the evolution of ices and organic matter in dense molecular clouds and young forming stellar systems, (2) the chemical evolution of organic molecules in the ISM as they transition from AGB outflows to planetary nebulae to the general diffuse ISM to H II regions and dense clouds, (3) the distribution of organics in the diffuse ISM, (4) the nature of organics in the Solar System (in comets, asteroids, satellites), and (5) the nature and distribution of organics in local galaxies. Both the scientific goals of the mission and how they would be achieved will be discussed.

Identifying Young, Nearby Stars

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Young stars have certain characteristics, e.g., high atmospheric abundance of lithium and chromospheric activity, fast rotation, distinctive space motion and strong X-ray flux, compared to that of older main sequence stars. We have selected a list of candidate young (<100Myr) and nearby (<60pc) stars based on their space motion and/or strong X-ray flux. To determine space motion of a star, one needs to know its coordinates (RA, DEC), proper motion, distance, and radial velocity. The Hipparcos and Tycho catalogues provide all this information except radial velocities.

We anticipate eventually searching ~1000 nearby stars for signs of extreme youth. Future studies of the young stars so identified will help clarify the formation of planetary systems for times between 10 and 100 million years. Certainly, the final output of this study will be a very useful resource, especially for adaptive optics and space based searches for Jupiter-mass planets and dusty protoplanetary disks.

We have begun spectroscopic observations in January, 2001 with the 2.3 m telescope at Siding Spring Observatory (SSO) in New South Wales, Australia. These spectra will be used to determine radial velocities and other youth indicators such as Li 6708Å absorption strength and Hydrogen Balmer line intensity. Additional observations of southern hemisphere stars from SSO are scheduled in April and northern hemisphere observations will take place in May and July at the Lick Observatory of the University of California. At SSO, to date, we have observed about 100 stars with a high resolution spectrometer (echelle) and about 50 stars with a medium spectral resolution spectrometer (the "DBS"). About 20% of these stars turn out to be young stars. Among these, two especially noteworthy stars appear to be the closest T-Tauri stars ever identified. Interestingly, these stars share the same space motions as that of a very famous star with a dusty circumstellar disk—beta Pictoris. This new finding better constrains the age of beta Pictoris to be ~10 Myr.